DEVELOPMENT OF EXPERIMENTAL STUDIES ACCORDING TO ASSESSMENT OF THE RELEASE OF FISSION PRODUCTS FROM SPENT NUCLEAR FUEL (SNF) OF THE ICE BREAKER "LENIN" REACTOR DUMPED IN THE KARA SEA

V.N.SOYFER[1], V.A.GORYACHEV[1], D.V. ANDREEV [2], A.B. GAIDUCHENKO [2], I.R.BARABANOV [3], Yu.N. ZHUKOV [4], E.A. YANOVICH [3]

[1]V.I.Il'ichev Pacific Oceanological Institute , Far-Eastern Branch RAS, 690041 Vladivostok, Russia, [2]Russian Research Centre "Kurchatov Institute",123182 Moscow, Russia., [3]Institute for Nuclear Research RAS, 117312 Moscow, Russia, [4] Institute for Navigation and Hydrography,199106 St.Peterburg, Russia

soyfervol@mail.ru

A threat assessment of the environmental pollution (such as the Arctic), coming from the objects with unloaded spent nuclear fuel (SNF) at the sea bottom, when protective barriers of SNF assemble are untight, remains a basic scientific problem of marine radioecology. Currently, the use of methods of episodic radioecological monitoring and numerical simulation does not yield reliable estimates of the level of radioactive contamination of the seabed and determination the radiation dose. There is also no method for determining the beginning of mass release of fission products (FP) from SNF (when walls are ruined) in sea water. There is a basic lack of knowledge about the processes of change over time concerning the safety of spent nuclear fuel at the sea bottom. New approach to the problem of conservative assessment of risk of natural and anthropogenous accident's results in sites of catastrophe and dumping of nuclear objects with SNF is proposed. Results of an experimental research of the uranium FP release from the spent oxide nuclear fuel at interaction with the sea water in the conditions simulating a zone in dumpsite of nuclear reactors cores are presented.

Cycle of our experimental studies in 2002-2010 on time dependence of release from fuel of a fission gas U-235 - krypton-85, and other FP – cesium-137, at SNF corrosion in sea water in the conditions modeling parameters of a near-bottom water layer in the Novaya Zemlya Basin was carried out in the RRC "Kurchatov Institute" (Soyfer et al., 2005). Measurements of the Kr-85 release (by sampling the gas) and Cs-137 release (by measuring the specific gamma-activity of water samples) were carried out periodically. The difference in the half-lives of Kr-85 (10.6 years) and Cs-137 (30 years) was taken into account in the calculation of FP release (% of initial content). The duration of the experiment up to the date makes more than 2700 days.

It is shown that release rate of Kr-85 at the initial time considerably exceeds release speed of Cs-137. The our assumption that Kr-85 can be used as early leakage indicator from untight SNF assamble in places of dumping is confirmed. At the same time, it was observed that the release curve of Kr-85 reaches saturation, while the yield of Cs-137 proceeds with almost constant rate. Average release rate of Kr-85 during the whole experiment was 0.015% per day; average release rate of Cs-137 was 0.001% per day for water with silt and 0.01% for clean water.

The new data allow to estimate the maximum integrated yield of all radionuclides from the SNF at the bottom of the Novaya Zemlya Basin. Total release of FP can be determined on the basis of measurement of activity of isotope Cs-137 in the given sample and the subsequent recalculation of this activity in weight of all fission products which are available in the sample using a well-known distribution of the fission fragments. The maximum integrated yields of Kr-85 and Cs-137 for different times are presented in Table.

Table. Maximum integrated yield of fission products (%) from spent UO_2 fuel.

Nuclide	Duration, days				
	300	**450**	**750**	**1350**	**2100**
Kr-85	10.1	11.6	15.5	16.7	16.8
Cs-137	2.0	3.7	7.0	17.0	22.1